

Chapter V.—THE DISTRIBUTION OF THE MARINE ALGÆ IN THE DEEPER WATERS OF BUZZARDS BAY AND VINEYARD SOUND.

By the deeper waters of Buzzards Bay and Vineyard Sound are meant the depths of 2 fathoms or more, thus excluding the coast line between tide marks and the shallows just below. The reader is referred to the "Description of dredging stations occupied during present Survey," section I, page 201, of this report, for detailed information as to the position of the stations, dates of the dredgings, depths, etc., which it is unnecessary to specify in this general account.

The varied character of the bottom of Buzzards Bay and Vineyard Sound is responsible for many peculiarities of the algal vegetation. There are reefs of large bowlders off certain exposed points, but frequently the bottom in such situations is composed chiefly of rounded pebbles of various sizes. Then there are regions of gravel often mixed with shells and shell fragments, and large tracts of sand which are veritable deserts as far as plant life is concerned. Finally, there are some very extensive regions of black mud, especially characteristic of the upper portions of Buzzards Bay; these are likewise very barren of plant life, except where beds of *Zostera marina* are present in relatively shallow water. These characteristics are fully described in section I, chapter II, pages 29-33, and are graphically shown on chart 227.

The lists of species are arranged after the plan in Collins' "Preliminary Lists of New England Plants: V. Marine Algæ," Rhodora, volume II, page 41, 1900. That is, they are grouped alphabetically in the order of the Chlorophyceæ, Phæophyceæ, and Rhodophyceæ. By far the greater number of species in the deeper waters belong to the Rhodophyceæ, the Phæophyceæ coming next in number, and the Chlorophyceæ claiming only a small proportion.

The dredgings of the survey fall into two groups, (1) those in the middle regions of the Bay and Sound, at some stations within one-fourth of a mile from the shore, but generally in water of 5 fathoms or more in depth, and (2) those "inshore," i. e., immediately skirting the coast line in water sometimes as shallow as 2 fathoms. The material in this account will for geographical reasons be grouped under the following headings:

1. The middle regions of Buzzards Bay.
2. The middle regions of Vineyard Sound.
3. Certain inshore regions of particular interest.
4. Some statistics relative to the distribution of algæ in Buzzards Bay and Vineyard Sound.

1. THE MIDDLE REGIONS OF BUZZARDS BAY.

Buzzards Bay, for convenience in this account, has been divided into an upper and lower portion by a line running from the west end of Naushon (Robinsons Hole) to Round Hill Point.

The upper portion of Buzzards Bay in the middle regions has a very scanty algal flora. This is easily accounted for by the character of the bottom, which for the most

part consists of mud or fine muddy sand. Mud and fine sand furnish poor attachment for algæ, and their shifting nature, especially when disturbed by storms and tide currents, give conditions very unfavorable for algal growth. The water is relatively shallow in this region, occasionally more than 7 fathoms deep, but generally under 6 fathoms. The following species were found growing in the upper portion of the Bay, the numbers referring to *Fish Hawk* stations:

Arthrocladia villosa, 7653, few.
Chordaria flagelliformis, 7653 and 7654, few.
Desmarestia aculeata, 7653 and 7655, few.
Desmarestia viridis, 7653 many; 7654, few.
Laminaria Agardhii, 7653 and 7654, few.
Ralfsia clavata, 7639, few.
Sargassum Filipendula, 7630 (1907), 7639, and 7654, few.
Agardhiella tenera, 7615, 7632, 7645, 7648, 7649, and 7650, few.
Callithamnion Baileyi, 7653, few.
Ceramium tenuissimum, 7652, few.
Champia parvula, 7610 (1907), 7653 and 7654, many; 7630 (1907), 7648 and 7651 (1907), few.
Cystoclonium purpurascens, 7653 and 7654, few.
Cystoclonium purpurascens var. *cirrhosum*, 7639 and 7653, few.
Dasya elegans, 7632, few.

Griffithsia tenuis, 7632, few.
Grinnellia americana, 7621, 7628, 7629 and 7648, many; 7615, 7624, 7625, 7630, 7632, 7634, 7635, 7639, 7649 and 7653, few.
Lithothamnion polymorphum, 7621, few.
Lomentaria uncinata, 7632 and 7653, few.
Phyllophora Brodiaei, 7610, 7611, 7613, 7614, 7615, 7617, 7618, 7627 and 7654, few.
Phyllophora membranifolia, 7635, many; 7610 (1907), 7621 (1907), 7630, 7630 (1907), 7631, 7632, and 7639 (1907), few.
Polysiphonia nigrescens, 7648, 7654, and 7655, many; 7610, 7615, 7636, 7637, 7638, 7639, 7649, and 7650, few.
Polysiphonia variegata, 7632, few.
Rhodomela subfusca, 7639 and 7652, few.
Rhodymenia palmata, 7653 and 7656, few.

The lower portion of Buzzards Bay presents conditions more varied than the upper portion. The depth is generally over 8 fathoms, and all of the stations of the greatest depth in the Bay (10 to 19 fathoms) are found in this region. The nature of the bottom changes near the entrance of the Bay from mud and sand, characteristic of the upper portion, to gravel and stones, present at a number of stations (7664, 7665, 7666, 7667, 7670, 7671, 7672, 7673). This is a much more favorable bottom for algæ, and the number of species and total quantity of vegetation are very much greater than in the upper portion of the Bay. The following species were found in the lower portion of the Bay:

Chorda filum, 7656, few.
Chordaria flagelliformis, 7656, many; 7667, few.
Desmarestia aculeata, 7656, 7657, 7662, and 7671, few.
Desmarestia viridis, 7665, few.
Dictyosiphon hippuroides, 7656, many.
Ectocarpus fasciculatus, 7656, many.
Laminaria Agardhii, 7656 and 7657, many; 7660, 7662, and 7663, few.
Laminaria Agardhii var. *vittata*, 7670, many; 7664, 7665, 7666, 7667, and 7671, few.
Ralfsia clavata, 7671, few.
Sargassum Filipendula, 7657, few.
Agardhiella tenera, 7661, few.
Ahnfeldtia plicata, 7656, few.
Antithamnion cruciatum, 7671, few.
Callithamnion Baileyi, 7656, many.
Ceramium rubrum, 7656, many; 7665 and 7670, few.

Champia parvula, 7661, 7662, and 7663, many; 7656, 7657, 7664, 7668, 7670, 7671, and 7672, few.
Chondrus crispus, 7656 and 7659, many; 7663, 7665, 7668, 7670, 7672, and 7673, few.
Corallina officinalis, 7663, many.
Cystoclonium purpurascens, 7656, 7659, and 7660, few.
Cystoclonium purpurascens var. *cirrhosum*, 7651 (1907), 7656, 7659, 7662 (1907), 7664, 7666, 7672, and 7673, few.
Dasya elegans, 7656, 7666, 7674, and 7675, few.
Delesseria sinuosa, 7664, few.
Grinnellia americana, 7671, many; 7660, 7661, 7663, 7670, and 7675, few.
Lithothamnion polymorphum, 7659, few.
Lomentaria uncinata, 7671 and 7675, few.
Melobesia membranacea, 7672, many.

Phyllophora Brodiaei, 7656, many; 7663, 7672 and 7673, few.	Polysiphonia nigrescens, 7659, many; 7656, 7664, 7666, 7668, and 7672, few.
Phyllophora membranifolia, 7659 and 7662, many; 7657, 7660, 7663 (1907), 7664, 7666, 7672 (1907), and 7675, few.	Polysiphonia urceolata, 7670, 7673, and 7675, few.
Pleonosporium Borreri, 7675, few.	Polysiphonia violacea, 7664, few.
Polyides rotundus, 7659, many; 7660 and 7666, few.	Rhodomela subfusca, 7656 and 7667, few.
Polysiphonia elongata, 7656, 7662 (1907), 7665, and 7675, few.	Rhodymenia palmata, 7664, 7665, 7666, 7667, 7670, and 7671, few.
	Seiropora Griffithsiana, 7660, few.
	Spyridia filamentosa, 7671, many; 7656 and 7675, few.

Summarizing this statement of the algal vegetation in Buzzards Bay, it may be said that the life conditions are much more favorable in the lower portions of the Bay than in the upper, since the bottom is generally stony and the water clearer, because silt and mud are less frequent. These characteristics are graphically shown on chart 227, and it will be noted that the greater part of Buzzards Bay has a muddy bottom. Such regions in the deeper waters are almost deserts as regards vegetation. The algal flora of the upper portion of Buzzards Bay is, in the summer, composed of species characteristic of the warm-water sublittoral formation, which also extends somewhat into the lower portions of the Bay. However, the vegetation changes markedly toward the entrance of the Bay, both as to its characteristics and its quantity, as is shown by the above lists. Species appear which are peculiar to the cool-water sublittoral formation. Around the exposed reefs of Sow and Pigs the vegetation is typical of this formation, which is presented in even greater luxuriance off Gay Head.

2. THE MIDDLE REGIONS OF VINEYARD SOUND.

The conditions in Vineyard Sound differ from those of Buzzards Bay in several respects. The tides which flow east with the flood and west with the ebb have a velocity of 1 to 3 knots an hour, which is so strong a current that extensive deposits of mud or fine silt are generally rendered impossible. The bottom is in consequence chiefly hard sand, frequently mixed with shell fragments, gravel, or stones. There is little or no mud in the middle regions of the Sound. The average depth is somewhat greater than that of the Bay, but not enough to be an important factor in determining the character of the vegetation. There are no large areas of shallows under 6 fathoms, as are found in the upper portion of Buzzards Bay, the Middle Ground being the only extensive region of shoal water, and that is composed chiefly of sand and is quite barren of vegetation.

Vineyard Sound within the limits of this Survey (that is, from a line drawn between the westerly end of Cuttyhunk and Gay Head to a line between Falmouth Heights and East Chop) has for convenience been divided into three regions as follows: (a) The westerly portion from the entrance to a line between the west end of Naushon (Robinsons Hole) and Kopeecon Point (Cape Higgon), (b) the narrow portion of the Sound between Naushon and Marthas Vineyard to a line connecting Nobska Point and West Chop, and (c) the easterly portion of the Sound from the last line to one between Falmouth Heights and East Chop.

The westerly portion of Vineyard Sound includes large areas with a bottom of hard sand or sand with shell fragments, but exceptions to these conditions were found at a

number of stations (see chart 227). The greatest depths were between 17 and 19 fathoms (chart 227), and the average for this portion of the Sound was about $12\frac{1}{3}$ fathoms. The following is the list of algæ found in the deeper waters of the westerly portion of Vineyard Sound:

- Arthrocladia villosa*, 7734, many; 7725, 7728 and 7729, few.
Chorda filum, 7567, 7571, and 7591, few.
Cladostephus verticillatus, 7717, many; 7598 and 7734, few.
Desmarestia aculeata, 7718, many; 7566, 7588, 7595, 7596, 7719, 7720, and 7730, few.
Desmarestia viridis, 7731 (1907), many; 7677, 7678, 7706, 7707, 7710, 7725, 7728, 7730, and 7734, few.
Dictyosiphon hippuroides, 7725, many; 7676, 7729, and 7730, few.
Ectocarpus siliculosus, 7717 and 7728, few.
Laminaria Agardhii, 7718, many; 7581 (1907), 7582, 7583, 7584, 7588, 7589, 7592, 7593, 7595, 7599, 7677, 7702, 7703, 7706, 7719, and 7728, few.
Laminaria Agardhii var. *vittata*, 7582, 7583, 7679, 7680, 7681, 7701, 7704, 7706, 7707, 7719, 7720, 7723, 7724, and 7731, few.
Laminaria digitata, 7593 and 7722, few.
Actinococcus subcutaneus, 7583 and 7595, few.
Agardhiella tenera, 7735, many; 7728, 7730, and 7734, few.
Ahnfeldtia plicata, 7593, 7598, 7599, 7718, 7719, 7720, 7721, 7724, and 7725, few.
Antithamnion cruciatum, 7724 and 7735, many; 7566, 7571, 7690, 7720, 7730, and 7734, few.
Antithamnion plumula, 7678, few.
Callithamnion roseum, 7725, few.
Ceramium rubrum, 7721, many; 7571, 7575, 7576, 7589, 7593, 7676, 7680, 7701, 7704, 7710, 7717, 7719, 7722, 7731 (1907), and 7734, few.
Ceramium tenuissimum, 7724, 7725, and 7726, many; 7730, few.
Champia parvula, 7572 and 7724, many; 7566, 7567, 7568, 7569, 7571, 7574, 7575, 7576, 7578, 7588, 7676, 7703, 7725, 7728, 7729, and 7734, few.
Chondrus crispus, 7718 and 7720, many; 7566, 7581 (1907), 7582, 7583, 7584, 7585, 7589, 7591, 7596, and 7731 (1907), few.
Corallina officinalis, 7566, 7583, and 7596, few.
Cystoclonium purpurascens, 7720 and 7729, few.
Cystoclonium purpurascens var. *cirrhosum*, 7707, 7730, and 7731 (1907), many; 7585, 7601, 7676, 7678, 7686, 7692, 7693, 7703, 7706, 7717, 7718, 7719, and 7722, few.
Dasya elegans, 7734, few.
Delesseria sinuosa, 7701, 7719, and 7720, many; 7582, 7591, 7593, 7595, 7690, 7692, 7693, 7703, 7709, and 7721, few.
Grinnellia americana, 7734 and 7735, many; 7575, 7576, 7589, 7724, 7725, 7727, 7729, 7730, and 7736, few.
Lomentaria rosea, 7593, 7708, and 7709, few.
Lomentaria uncinata, 7734 and 7735, few.
Melobesia pustulata, 7582, many.
Phyllophora Brodiaei, 7583, 7584, 7591, 7595, 7596, and 7598, few.
Phyllophora membranifolia, 7706, 7710, 7719, 7722, 7725, and 7729, few.
Plumaria elegans, 7720, many; 7584, 7719, and 7728, few.
Polyides rotundus, 7581 (1907), 7701, and 7717, few.
Polysiphonia elongata, 7685, 7701, 7723, and 7726, many; 7581 (1907), 7678, 7686, 7698, 7702, 7706, 7709, 7717, 7724, 7725, 7727, 7728, 7730, 7731 (1907), and 7734, few.
Polysiphonia nigrescens, 7724, 7725, 7728, 7729, 7730, 7731 (1907), and 7734, many; 7581 (1907), 7717, 7718, and 7726, few.
Polysiphonia violacea, 7681, 7704, and 7721, few.
Rhodomela Rochei, 7731 (1907), few.
Rhodomenia palmata, 7567, 7569, 7578, 7582, 7584, 7585, 7588, 7591, 7593, 7595, 7701, 7703, 7708, 7718, 7719, 7720, 7723, 7724, 7728, 7729, and 7731 (1907), few.
Seirospora Griffithsiana, 7728, many; 7729, few.
Spermothamnion Turneri, 7585, 7588, 7589, 7598, 7717, and 7719, few.
Spyridia filamentosa, 7724, 7725, 7726, and 7735, many; 7571, 7572, 7588, and 7720, few.

It is an interesting fact that the growths of algæ are most luxuriant nearest Gay Head, the Cuttyhunk side of Vineyard Sound in the deeper waters being very barren of vegetation. The depth is nowhere sufficiently great to be an important factor in determining the distribution of the algæ, for stations 7719 (17 fathoms), 7582, 7583, and 7584 (all about 15 fathoms) gave a large variety of species in considerable quantity. Gravelly and rocky bottoms generally have the greatest quantity of vegetation. The dredgings determined the presence of extensive areas of sand, which support little or

no algal life. The most important of these were around the following groups of stations: (7677, 7592); (7708, 7709, 7590); (7679, 7681, 7702); (7577, 7597, 7682, 7698, 7699, 7700, 7727); (7573, 7574, 7695); (7569, 7570, 7736).

Proceeding eastward into the Sound from the entrance the most marked change in the algal life is the appearance of such species as *Arthrocladia villosa*, *Chorda filum*, *Dictyosiphon hippuroides*, *Agardhiella tenera*, *Ceramium tenuissimum*, *Champia parvula*, and *Grinnellia americana*. These were not found in the deeper waters at the entrance of the Sound, but were all fairly abundant eastward, *Agardhiella*, *Champia*, and *Grinnellia* being very characteristic of the Sound flora from this point on.

The most striking feature of the summer flora in the deeper waters at the entrance of Vineyard Sound is the presence in considerable quantity of certain species restricted wholly or almost wholly to the more open waters included in the survey. Prominent among these are *Laminaria Agardhii* var. *vittata*, *Laminaria digitata*, *Delesseria sinuosa*, *Lomentaria rosea*, *Plumaria elegans*, and *Rhodymenia palmata*. Considered as a whole, the flora at the westerly entrance of Vineyard Sound takes its chief interest from the presence of species peculiar to the cool-water sublittoral formation.

The narrow portion of Vineyard Sound will now be described. This lies between the islands of Naushon and Marthas Vineyard and may be included between a line drawn from Kopeecan Point to the west end of Naushon (Robinsons Hole) and a line from West Chop to Nobska Point. The bottom is much more varied (see chart 227) than in the westerly portion of the Sound, which in the deeper waters is almost entirely hard sand. There are, however, some extensive areas of sand adjacent to similar regions in the westerly portion of the Sound, and the region between the Middle Ground and Marthas Vineyard is likewise sandy. A few stations (7554, 7564, and 7697) presented a muddy bottom. All other stations comprising the greater part of the middle region of this portion of the Sound showed a bottom of gravel or gravel and stones. The general character of the bottom may be described as variegated, areas of gravel lying next to areas of sand or of large pebbles, the distribution of the sand being determined in all probability largely by the varied flow and scouring of the tidal currents. The greatest depths were from 15 to 17 fathoms; the average depth about 10 fathoms.

The following algæ were found in the deeper waters of this, the narrowest portion of the Sound:

<i>Arthrocladia villosa</i> , 7733 many; 39 and 7732, few.	<i>Actinococcus subcutaneus</i> , 7521bis and 7525bis, many; 7522bis and 7525bis, few.
<i>Chorda filum</i> , 7542bis, 7551, 7557, and 7559, few.	<i>Agardhiella tenera</i> , 7525bis, many; 7533, 7533bis, 7535, 7536, 7537, 7540, 7541, 7541bis, 7542, 7543bis, 7553, 7559, 7562, 7733, 7744, 7751, 7753, and 7754, few.
<i>Chordaria flagelliformis</i> , 7524 and 7525, few.	<i>Ahnfeldtia plicata</i> , 7524bis and 7525bis, few.
<i>Cladostephus verticillatus</i> , 7525bis, 7744, and 7753, few.	<i>Antithamnion cruciatum</i> , 7543bis and 7554bis, many; 7521bis, 7522bis, 7523bis, 7533bis, 7541bis, 7732, 7744, and 7745, few.
<i>Desmarestia aculeata</i> , 7739, few.	<i>Callithamnion Baileyi</i> , 7523, few.
<i>Desmarestia viridis</i> , 7525bis, many; 7522bis, 7524bis, 7543bis, and 7549 (1907), few.	<i>Callithamnion roseum</i> , 7521bis, 7744, and 7754, few.
<i>Ectocarpus siliculosus</i> , 7525bis, few.	<i>Ceramium fastigiatum</i> , 7542 and 7548, few.
<i>Laminaria Agardhii</i> , 7525bis, many; 7524bis, 7532bis, 7533bis, 7536, 7541, 7557, 7732, 7739, 7740, and 7749, few.	<i>Ceramium rubrum</i> 7542, 7551, 7551 (1907), and 7557, many; 7524, 7525, 7541bis, 7548, 7554, 7559, 7560, 7565bis, 7732, 7733, 7739, 7746, and 7749, few.
<i>Mesogloia divaricata</i> , 7548, few.	<i>Ceramium strictum</i> , 7746, few.
<i>Ralfsia clavata</i> , 7524bis, few.	
<i>Sargassum Filipendula</i> , 7525bis, 7533bis, 7537, 7551, 7554, 7555, 7557, 7740, 7742, 7744, 7749, and 7750, few.	

- Ceramium tenuissimum*, 7542bis, many; 7530bis, 7541bis, 7554bis, 7559, and 7565bis, few.
- Champia parvula*, 7549bis, 7732, 7733, 7745, 7749, 7752, and 7754, many; 7521, 7521 (1907), 7523bis, 7525, 7525bis, 7526 (1907), 7533bis, 7534, 7541, 7541bis, 7542, 7542 (1907), 7543 (1907), 7547, 7549 (1907), 7551, 7551 (1907), 7553, 7554, 7554bis, 7557, 7559, 7560, 7562, 7565bis, 7739, 7741, 7746, and 7753, few.
- Chondrus crispus*, 7521 (1907), 7533bis, and 7749, many; 7523bis, 7524bis, 7525bis, 7536, 7542bis, 7554, 7554bis, 7560, 7561, 7562, 7732, 7739, and 7746, few.
- Corallina officinalis*, 7531bis, many.
- Cystoclonium purpurascens*, 7524bis, 7525bis, 7542 (1907), and 7549 (1907), few.
- Cystoclonium purpurascens* var. *cirrhosum*, 39, 7523, 7534, and 7740, few.
- Dasya elegans*, 7733, 7751, and 7753, few.
- Delesseria sinuosa*, 39, few.
- Gracilaria multipartita*, 7554bis, few.
- Griffithsia Bornetiana*, 7533bis, 7749, and 7754, few.
- Grinnellia americana*, 7542 and 7733, many; 7521, 7521 (1907), 7525bis, 7527, 7531bis, 7536, 7537, 7540, 7541, 7546, 7547, 7549, 7551, 7553, 7554, 7556bis, 7557, 7559, 7560, 7562, 7565bis, 7732, 7737, 7741, and 7753, few.
- Hildenbrandia prototypus*, 7544bis and 7547bis, many; 7533bis, 7546bis, and 7747, few.
- Lithothamnion polymorphum*, 7524bis, 7525bis, 7533bis, 7534bis, and 7544bis, many; 7534, 7535bis, 7539, 7539bis, and 7752, few.
- Lomentaria uncinata*, 7537, 7548, 7551, 7557, 7733, and 7751, few.
- Melobesia Lejolisii*, 7525bis, many.
- Melobesia membranacea*, 7739, few.
- Phyllophora Brodiaei*, 7521bis, 7523, 7524, 7525bis, 7526 (1907), and 7533bis, many; 7522bis, 7524bis, 7525, 7530, 7532, 7534, 7535, 7536, 7536bis, 7537, 7541, 7542 (1907), 7739, 7744, and 7749, few.
- Phyllophora Brodiaei* var. *catenata*, 7521 (1907), many.
- Phyllophora membranifolia*, 7521bis, 7525bis, 7531bis, 7533bis, 7739, 7740, 7742, 7744, and 7749, many; 7523bis, 7524bis, 7530 (1907), 7542bis, 7543 (1907), 7549 (1907), 7741, 7743, 7745, and 7754, few.
- Polyides rotundus*, 7752, many; 7526 (1907), 7532bis, 7533bis, 7536, 7541bis, 7560, 7749, and 7751, few.
- Polysiphonia elongata*, 7557, 7733, 7739, 7751, 7752, and 7754, few.
- Polysiphonia nigrescens*, 7752, many; 7523bis, 7549 (1907), 7551, and 7551 (1907), few.
- Polysiphonia violacea*, 7523bis, few.
- Rhodomela subfusca*, 7554bis, few.
- Rhodomenia palmata*, 7530bis, few.
- Spermothamnion Turneri*, 7525bis, 7533bis, and 7749, many; 7521bis, 7524, 7526 (1907), 7530bis, 7537, 7542, 7548, 7551, 7553, 7560, 7562, 7739, 7741, 7751, 7752, and 7754, few.
- Spyridia filamentosa*, 7530bis, 7533bis, 7542, 7559, 7562, 7741, and 7749, few.

The narrow portion of Vineyard Sound as well as the westerly portion presents some large areas practically devoid of vegetation for the reason that the bottom is sandy. The chief of these regions are around stations (7556, 7562, 7563, 7564, 7565, 7697), (7547, 7549, 7550, 7551, 7552, 7553), (7536, 7539, 7543, 7544, 7545, 7736, 7737), (7530, 7531), (7521, 7522, 7527, 7528, 7529, 7532, 7533).

The more varied character of the bottom in the deeper waters of the narrow portion of the Sound gives a larger representation of algæ, both in abundance and in number of species, than the westerly portion. Certain species appear which were not noted or were uncommon in the deeper waters of the westerly portion: *Chordaria flagelliformis*, *Mesogloia divaricata*, *Sargassum Filipendula*, *Ralfsia clavata*, *Callithamnion Baileyi*, *Ceramium fastigiatum*, *Ceramium strictum*, *Gracilaria multipartita*, *Griffithsia Bornetiana*, *Hildenbrandia prototypus*, *Lithothamnion polymorphum*, *Melobesia membranacea*, and *Rhodomela subfusca*.

Other species characteristic of more open waters are not present in this part of the Sound or are very rare; conspicuous among these are *Chaetomorpha melagonium*, *Laminaria Agardhii* var. *vittata*, *Laminaria digitata*, *Delesseria sinuosa*, *Lomentaria rosea*, *Plumaria elegans*, and *Rhodomenia palmata*. Considering the list as a whole, the most striking features are the abundance and widespread distribution of *Sargassum Filipendula*, *Agardhiella tenera*, *Ceramium rubrum*, *Champia parvula*, *Chondrus crispus*, *Grin-*

nellia americana, *Phyllophora Brodiaei*, *Phyllophora membranifolia*, and *Spermothamnion Turneri*; these species are found at 12 or more stations each, and may be considered the dominant forms. The list in general clearly shows that the algæ of the summer in the deeper waters of the narrow portion of Vineyard Sound belong to the warm-water sublittoral formation.

The easterly portion of Vineyard Sound^a included in this Survey is a triangular region between a line drawn from Nobska Point to West Chop and a line between Fal-mouth Heights and East Chop. The bottom here is much more stony than in the westerly portion of the Sound (see chart 227). While there is considerable sand in spots, there are no sandy areas so extensive as to include several stations. This region, therefore, may be described in general as gravelly, stony, and rocky, with sand in spots. The greatest depths were about 13 fathoms (chart 227), the average about 9 fathoms.

The following algæ were found in the easterly portion of the Sound:

Arthrocladia villosa, 7755, few.	Cystoclonium purpurascens, 7760, few.
Cladostephus verticillatus, 7760, 7771, and 7779, few.	Dasya elegans, 7775, many; 7755, 7768, 7770, 7777, 7778, 7779, 7780, 7781, 7782, and 7783, few.
Dictyosiphon hippuroides, 7760, few.	Gracilaria multipartita, 7766, few.
Laminaria Agardhii, 7755, 7767, 7775, and 7776, few.	Griffithsia Bornetiana, 7755, 7778, and 7782, few.
Ralfsia clavata, 7780, few.	Grinnellia americana, 7755, 7756, 7758, 7759, 7760, 7763, 7764, 7766, 7767, 7768, 7771, 7772, 7774, 7775, 7776, 7777, 7778, 7779, 7780, 7780 (1907), 7781, 7782, and 7783, few.
Sargassum Filipendula, 7755, 7760, 7763, 7764, 7766, 7767, 7772, 7775, 7776, 7778, 7780, 7781, and 7783, few.	Hildenbrandia prototypus, 7757, 7759, 7760, 7766, 7777, 7778, and 7780, few.
Sphacelaria cirrhosa, 7760 many; 7772, few.	Lithothamnion polymorphum, 7760, many; 7757, 7763 (1907), 7764, 7766, 7767, 7769, 7772, and 7778, few.
Agardhiella tenera, 7778 many; 7755, 7758, 7760, 7763, 7763 (1907), 7764, 7765, 7766, 7766 (1907), 7771, 7772, 7775, 7777, 7779, 7780, 7781, 7782, and 7783, few.	Lomentaria uncinata, 7760, many; 7757, 7759, 7763, 7764, 7766, 7777, 7778, 7781, and 7782, few.
Ahnfeldtia plicata 7760, few.	Melobesia Lejolisii, 7779, 7780, and 7782, many.
Antithamnion cruciatum, 7764, 7768, 7770, 7772, 7773, and 7774, many; 7757, 7760, 7765, 7766, 7771, 7774, 7779, and 7780, few.	Melobesia pustulata, 7768 and 7770, many; 7764 and 7765, few.
Callithamnion Baileyi, 7768 and 7772, many; 7778, few.	Phyllophora Brodiaei, 7763 (1907) and 7766, few.
Callithamnion roseum, 7764, 7767, 7770, 7771, 7772, 7774, 7775, and 7776, many; 7756, 7759, 7766, 7768, 7769, 7773, 7778, 7779, 7780, 7781, and 7782, few.	Phyllophora membranifolia, 7770 and 7775, many; 7755, 7759, 7760, 7764, 7765, 7766, 7768, 7769, 7772, 7774, 7780, 7782, and 7783, few.
Callithamniotetragonum, 7764, 7765, and 7766, few.	Polyides rotundus, 7759 and 7766, few.
Ceramium rubrum, 7755, many.	Polysiphonia elongata, 7760, 7766, 7772, and 7780, few.
Ceramium strictum, 7763 and 7764, few.	Polysiphonia fibrillosa, 7759, few.
Ceramium tenuissimum, 7777 and 7783, many; 7781, few.	Polysiphonia Harveyi, 7778, 7779, 7780, 7781, 7782, and 7783, few.
Champia parvula, 7760, 7764, 7775, and 7776, many; 7756, 7757, 7758, 7759, 7763, 7763 (1907), 7765, 7766, 7767, 7769, 7770, 7771, 7772, 7774, 7777, 7778, 7779, 7780, 7781, 7782, and 7783, few.	Polysiphonia nigrescens, 7760 and 7763 (1907), few.
Chondria dasyphylla, 7755, 7774, 7777, 7778, 7781, 7782, and 7783, few.	Polysiphonia violacea, 7780, few.
Chondrus crispus, 7764, 7766, and 7768, many; 7759, 7760, 7763 (1907), 7765, 7767, 7769, 7770, 7771, 7772, 7777, 7779, and 7781, few.	Rhodymenia palmata, 7755, few.
	Spermothamnion Turneri, 7764, 7770, 7772, and 7775, many; 7755, 7759, 7760, 7763, 7771, 7774, 7777, 7779, 7780, 7781, and 7782, few.
	Spyridia filamentosa, 7776, many; 7759, 7760, 7763, 7763 (1907), and 7783, few.

^a As stated before, this region might be considered as within the limits of Nantucket Sound if an arbitrary line were drawn between this body of water and Vineyard Sound.

The proportionate amount of algal life was very much greater in the deeper waters of this, the easterly portion of Vineyard Sound, than in the other regions, and there were no extensive barren areas. The character of the algal flora was essentially similar to that in the narrow portion of the Sound. The following species, however, present in the narrow portion, were not observed, although it is probable that all of the forms occur at times in this region:

Chorda filum.
Chordaria flagelliformis.
Desmarestia aculeata.
Desmarestia viridis.
Ectocarpus siliculosus.
Mesogloia divaricata.
Ralfsia clavata.

Actinococcus subcutaneus.
Ceramium fastigiatum.
Corallina officinalis.
Cystoclonium purpurascens var. *cirrhosum*.
Melobesia membranacea.
Rhodomela subfusca.

Some algae were found which are not recorded in the previous lists: *Sphacelaria cirrhosa*, *Callithamnion tetragonum*, *Chondria dasyphylla*, *Melobesia Lejolisii*, *Polysiphonia fibrillosa*, and *Polysiphonia Harveyi*. However, most of these latter were in small quantities, and the *Melobesia Lejolisii* and *Polysiphonia Harveyi* occur in relation to beds of *Zostera*. The summer algal flora of the easterly portion of Vineyard Sound is clearly representative of the warm-water sublittoral formation.

3. CERTAIN INSHORE REGIONS OF PARTICULAR INTEREST.

It would be impossible in the limits of this paper to describe in detail the character of the vegetation along the entire coast line of Buzzards Bay and Vineyard Sound as determined from the dredgings at the inshore stations. There are, however, certain regions of particular interest because of various physiographical peculiarities, and of these the following will be briefly described: (1) Gay Head and vicinity, (2) the reefs of Sow and Pigs, (3) the passage of Woods Hole, (4) Robinsons Hole, (5) Quicks Hole, (6) Menemsha Bight, (7) Tarpaulin Cove, (8) Vineyard Haven, (9) Cove west of Cuttyhunk Neck, (10) the Middle Ground.

(1) GAY HEAD AND VICINITY.

The most interesting region in the limits of the Survey with respect to algal life is that around Gay Head. This area presents a greater luxuriance of growth and variety of species than any neighboring region, chiefly on account of the varied character of the bottom and also because a number of forms characteristic of cold waters are able to live on the exposed reefs and ledges. Conspicuous among these are *Laminaria digitata*, *Delesseria sinuosa*, *Gymnogongrus norvegicus*, *Lomentaria rosea*, *Plumaria elegans*, and *Euthora cristata*. *Euthora cristata* was dredged by W. G. Farlow off Gay Head in 8 to 10 fathoms in September, 1871, but we have not been fortunate enough to find this striking species, indicating that it is not common. The conditions under which most of the algae of this region live are clearly those of the cool-water sublittoral formation.

The region is complex and there are at least three clearly defined zones. The first zone (stations 50 and 51) is in shallow water and includes large rocks, some of which rise above the water, with sandy areas between them. The second zone (stations 44

to 49) comprises various reefs that lie off Gay Head, and especially the ledge known as Devils Bridge; these rocks are in 2 to 5 fathoms and the bottom between them is sandy. The third zone (stations 56-60, 7581 and 7731) is in deeper water outside of the reefs and has a rocky, gravelly, or sandy bottom in 5 to 12 fathoms. These zones will be considered in order.

The first zone (stations 50 and 51) in shallow water was studied August 9, 1904. It comprised the following species, chiefly growing on rocks:

<i>Calothrix scopulorum</i> (on piles).	<i>Phyllitis fascia</i> .
<i>Chætomorpha area</i> (on piles).	<i>Scytosiphon lomentarius</i> .
<i>Cladophora albida</i> var. <i>refracta</i> ,	<i>Ahnfeldtia plicata</i> .
<i>Enteromorpha intestinalis</i> .	<i>Callithamnion Baileyi</i> (on <i>Chondrus</i>).
<i>Enteromorpha prolifera</i> .	<i>Ceramium rubrum</i> (on <i>Chondrus</i>).
<i>Ulva Lactuca</i> var. <i>rigida</i> .	<i>Champia parvula</i> .
<i>Chorda filum</i> .	<i>Chondrus crispus</i> .
<i>Chordaria flagelliformis</i> .	<i>Cystoclonium purpurascens</i> var. <i>cirrhosum</i> .
<i>Desmotrichum undulatum</i> (on <i>Zostera</i>).	<i>Nemalion multifidum</i> .
<i>Ectocarpus fasciculatus</i> (on larger algæ).	<i>Pleonosporium Borreri</i> (on larger algæ).
<i>Ectocarpus siliculosus</i> (on larger algæ).	<i>Polysiphonia fibrillosa</i> .
<i>Fucus evanescens</i> .	<i>Polysiphonia nigrescens</i> .
<i>Fucus vesiculosus</i> .	<i>Polysiphonia violacea</i> .
<i>Fucus vesiculosus</i> var. <i>sphærocarpus</i> .	<i>Rhodomela subfusca</i> (on piles).
<i>Laminaria Agardhii</i> .	<i>Rhodymenia palmata</i> .
<i>Laminaria digitata</i> .	<i>Spermothamnion Turneri</i> .

The second zone (stations 44 to 49) was also studied August 9, 1904. The list of species is as follows:

<i>Chætomorpha melagonium</i> , 44 and 45, few.	<i>Delesseria sinuosa</i> , 45, many; 46, few.
<i>Chorda filum</i> , 47 and 49, few.	<i>Grinnellia americana</i> , 49, few.
<i>Desmarestia aculeata</i> , 46, 47, and 48, few.	<i>Lomentaria rosea</i> , 45, few.
<i>Desmarestia viridis</i> , 46, few.	<i>Melobesia pustulata</i> , 45, 46, 47, and 49, many; 44, few.
<i>Ectocarpus siliculosus</i> , 44 and 45, few.	<i>Phyllophora Brodiaei</i> , 45, many; 44, 46, 47, 48, and 49, few.
<i>Laminaria Agardhii</i> , 44, 45, 46, 47, and 49, few.	<i>Plumaria elegans</i> , 44, few.
<i>Laminaria Agardhii</i> var. <i>vittata</i> , 44, 45, and 47, few.	<i>Polyides rotundus</i> , 46, 47, and 48, many; 44, few.
<i>Laminaria digitata</i> , 44 and 48, few.	<i>Polysiphonia elongata</i> , 44 and 45, many; 46, 47, 48, and 49, few.
<i>Ahnfeldtia plicata</i> , 47 and 49, many; 44, 46, and 48, few.	<i>Polysiphonia nigrescens</i> , 49, many; 47, few.
<i>Ceramium fastigiatum</i> , 44, few.	<i>Polysiphonia violacea</i> , 45 and 48, few.
<i>Ceramium rubrum</i> , 44, 45, 46, 47, and 48, few.	<i>Rhodymenia palmata</i> , 45, 46, and 47, many; 44 and 48, few.
<i>Champia parvula</i> , 49, many; 44, 46, and 47, few.	<i>Seirospora Griffithsiana</i> , 49, few.
<i>Chondrus crispus</i> , 44, 45, 46, 47, 48, and 49, many.	<i>Spermothamnion Turneri</i> , 44, 45, and 46, many; 47 and 49, few.
<i>Corallina officinalis</i> , 47, many; 44, 45, and 48, few.	
<i>Cystoclonium purpurascens</i> , 44 and 49, many.	
<i>Cystoclonium purpurascens</i> var. <i>cirrhosum</i> , 44, 45, 46, and 47, many; 48 and 49, few.	

The third zone (stations 56-60, 7581 and 7731) was studied August 15, 1904. The following list includes the species of the seven stations:

<i>Chætomorpha melagonium</i> , 56, 57, 58, and 60, few.	<i>Laminaria Agardhii</i> , 57, 59, 60, 7581 (1907), and 7731, few.
<i>Arthrocladia villosa</i> , 56, many.	<i>Laminaria Agardhii</i> var. <i>vittata</i> , 57 and 7731, many; 59 and 60, few.
<i>Desmarestia aculeata</i> , 57, many; 56, 59, 60, and 7731, few.	<i>Ralfsia clavata</i> , 57, many; 56, 58, and 59, few.
<i>Desmarestia viridis</i> , 57, 58, 7731, and 7731 (1907), many; 59, few.	<i>Ahnfeldtia plicata</i> , 60, few.

<i>Antithamnion cruciatum</i> , 56, few.	<i>Melobesia farinosa</i> , 57 and 58, many.
<i>Antithamnion plumula</i> , 57 and 58, few.	<i>Melobesia membranacea</i> , 56, 57, and 58, many.
<i>Callithamnion roseum</i> , 57, few.	<i>Melobesia pustulata</i> , 57, few.
<i>Ceramium rubrum</i> , 57 and 7731, many; 59 and 7731 (1907), few.	<i>Phyllophora Brodiaei</i> , 56, 57, and 58, many; 59, few.
<i>Chondrus crispus</i> , 56, 57, and 58, many; 59, 60, 7581 (1907), and 7731 (1907), few.	<i>Phyllophora membranifolia</i> , 56, 57, and 58, many; 60, few.
<i>Corallina officinalis</i> , 56 and 57, many; 58, 60, and 7581, few.	<i>Plumaria elegans</i> , 57, 58, and 59, many.
<i>Cystoclonium purpurascens</i> , 56, 57, 58, and 59, many; 60, few.	<i>Polydides rotundus</i> , 56, 57, 58, 60, and 7581 (1907), few.
<i>Cystoclonium purpurascens</i> var. <i>cirrhosum</i> , 56, 58, 59, and 7731 (1907), many; 60, 7581 (1907), and 7731, few.	<i>Polysiphonia atrorubescens</i> , 56, many.
<i>Delesseria sinuosa</i> , 56, 57, and 58, many; 7731, few.	<i>Polysiphonia elongata</i> , 56, 59, and 7731, many; 60, 7581 (1907), and 7731 (1907), few.
<i>Grinnellia americana</i> , 56, many; 7581, few.	<i>Polysiphonia nigrescens</i> , 60 and 7731, many; 59, 7581 (1907), and 7731 (1907), few.
<i>Gymnogongrus norvegicus</i> , 56, few.	<i>Rhodomela subfusca</i> , 56, few.
<i>Hildenbrandia prototypus</i> , 58 and 59, many.	<i>Rhodomela Rochei</i> , 7731 (1907), few.
<i>Lithothamnion polymorphum</i> , 57, 58, 59, and 60, many.	<i>Rhodymenia palmata</i> , 59, many; 60 and 7731 (1907), few.
<i>Lomentaria rosea</i> , 57 and 58, many; 56 and 59, few.	<i>Scinaia furcellata</i> , 57, few.
	<i>Spermothamnion Turneri</i> , 56, 57, and 58, many; 59, few.

(2) THE REEFS OF SOW AND PIGS.

The bottom around the reefs of Sow and Pigs (stations 35, 36 and 37), lying off Cuttyhunk, has an algal flora noteworthy for the presence of such species as *Delesseria sinuosa*, *Lomentaria rosea*, and *Plumaria elegans*, forms which are also characteristic of the ledges off Gay Head and are members of the cool-water sublittoral formation. The quantity of algæ is, however, not great. An examination of the reefs themselves, although difficult, would doubtless prove interesting. There were considerable amounts of *Corallina officinalis* (35, 36, 37), *Delesseria sinuosa* (35, 36), *Phyllophora Brodiaei* (35, 36, 37), and *Plumaria elegans* (36, 37), and in addition relatively few plants of *Chaetomorpha melagonium* (37), *Ectocarpus fasciculatus* (37), *Laminaria Agardhii* var. *vittata* (36, 37), *Ahnfeldtia plicata* (36), *Ceramium rubrum* (37), *Ceramium tenuissimum* (35), *Chondrus crispus* (35, 36), *Cystoclonium purpurascens* var. *cirrhosum* (35, 36, 37), *Lithothamnion polymorphum* (35), *Lomentaria rosea* (37), *Melobesia pustulata* (36), *Rhodymenia palmata* (36), and *Spermothamnion Turneri* (35).

(3) THE PASSAGE OF WOODS HOLE.

The easterly side of the passage of Woods Hole (station 122) off the end of the hook-shaped point of land called Penzance (Long Neck) has a sand and gravel bottom in 4 to 5 fathoms. The following species were found in small quantities: *Champia parvula*, *Dasya elegans*, *Griffithsia Bornetiana*, *Grinnellia americana*, *Phyllophora Brodiaei*, *Polysiphonia nigrescens*, *Rhodomela Rochei*, and *Seirospora Griffithsiana*.

The westerly side of the passage off Uncatena Island (station 118) on a bottom of sand and shells showed small quantities of *Chordaria flagelliformis*, *Ceramium rubrum*, *Chondrus crispus*, *Cystoclonium purpurascens*, and *Lomentaria uncinata*. Off the entrance to Hadley Harbor (stations 119 and 120) the bottom is sand and mud, and appears to support no algal life.

The main channel near Hadley Rock (station 121) has a bottom of sand and stones. There was an abundance of *Laminaria Agardhii*, *Agardhiella tenera*, *Chondrus crispus*, and *Gracilaria multipartita*, together with a few plants of *Sargassum Filipendula*. Dredgings of previous years have shown that *Callithamnion roseum* grows on shells in the narrower portion of the passage (Woods Hole proper), and also *Scinaia furcellata*. The passage on the south is bordered by ledges, chiefly submerged, and these are covered with heavy growths of algæ. The reader may obtain a general idea of the character of the algal life on these rocks bordering the channel from chapter IV, page 476, "A Report on the Algæ of Spindle Rocks, Woods Hole Harbor," a small group of rocks (destroyed in the summer of 1905) that formerly lay between Grassy Ledge and Red Ledge. These submerged ledges are difficult to study, but detailed examinations of some of them carried on through various seasons of the year would undoubtedly give some interesting results.

The algal life on the bottom of the harbor of Woods Hole and in the two ships' channels that lead into it from Vineyard Sound on either side of Great Ledge is very sparse. The bottom is hard sand and sandy mud, unfavorable for extensive growths of algæ. A haul (station 4) inside of Great Ledge in 2 to 5 fathoms over a sandy bottom gave a few plants of *Antithamnion cruciatum*, *Ceramium rubrum*, *Chondrus crispus*, *Gracilaria multipartita*, *Grinnellia americana*, *Melobesia Lejolisii* (on *Zostera*), and *Phyllophora Brodiaei*.

(4) ROBINSONS HOLE.

Robinsons Hole, along the west end of Naushon (stations 20, 21 and 22), has a rich algal flora over a stony bottom in 2 to 3½ fathoms. There was an abundance of:

Chorda filum, 21 and 22.
Desmarestia aculeata, 20, 21 and 22.
Desmarestia viridis, 20 and 22.
Laminaria Agardhii var. *vittata*, 21.
Antithamnion cruciatum, 22.
Ceramium fastigiatum, 20.
Ceramium rubrum, 20, 21 and 22.
Chondrus crispus, 20, 21 and 22.
Cystoclonium purpurascens, 20 and 22.

Cystoclonium purpurascens var. *cirrhosum*, 20 and 22.
Hildenbrandia prototypus, 21 and 22.
Lithothamnion polymorphum, 21.
Phyllophora Brodiaei, 20, 21 and 22.
Phyllophora membranifolia, 22.
Rhodymenia palmata, 21 and 22.
Scinaia furcellata, 21.
Spermothamnion Turneri, 20

In small quantities were found:

Cladophora gracilis, 20 and 21.
Cladostephus verticillatus, 21.
Ectocarpus siliculosus, 21.
Laminaria Agardhii, 22.
Leathesia difformis, 20.
Phyllitis fascia, 22.
Ahnfeldtia plicata, 21 and 22.

Ceramium strictum, 20.
Champia parvula, 20, 21 and 22.
Corallina officinalis, 20 and 21.
Dasya elegans, 21.
Lomentaria uncinata, 21 and 22.
Polysiphonia fibrillosa, 20.
Polysiphonia nigrescens, 20 and 22.

Station 23, off the island of Pasque, at the entrance to Robinsons Hole, showed the presence of much *Antithamnion cruciatum*, *Chondrus crispus*, *Phyllophora membranifolia*, *Rhodymenia palmata*, and a few plants of *Desmarestia aculeata*, *Desmarestia viridis*, and *Polysiphonia elongata*.

This flora has a mixed composition including forms characteristic of both the cool and warm-water sublittoral formations, indicating that the summer conditions of Robinsons Hole are somewhat midway between those of the open and those of the sheltered waters of the Sound and Bay.

(5) QUICKS HOLE.

Quicks Hole does not have so luxuriant a vegetation as Robinsons Hole, probably because the bottom is not so rocky. On the easterly side (station 27), along the west end of Pasque, in 4 to 5 fathoms over a rocky bottom, there was a rich growth of *Desmarestia aculeata*, *Laminaria Agardhii* var. *vittata*, *Callithamnion Baileyi*, *Phyllophora Brodiaei*, *Rhodymenia palmata*, and a few plants were found of *Desmarestia viridis* and *Cystoclonium purpurascens* var. *cirrhosum*. The westerly side (station 28 and 29) has a sandy bottom in 3 to 5 fathoms, with quite a different vegetation. There were found in abundance *Chorda filum* (station 29), *Desmarestia aculeata* (station 29), *Desmotrichum undulatum* (station 29, on *Zostera*), *Ectocarpus siliculosus* (station 29, on *Zostera*), *Melobesia Lejolisii* (station 29, on *Zostera*), and *Spermothamnion Turneri*. The following were found in small quantities:

Chordaria flagelliformis, 29.
Laminaria Agardhii, 28.
Leathesia difformis, 29.
Agardhiella tenera, 28.
Chondrus crispus, 29.
Corallina officinalis, 29.

Cystoclonium purpurascens, 29.
Hildenbrandia prototypus, 28.
Lithothamnion polymorphum, 28.
Polysiphonia elongata, 29.
Polysiphonia fibrillosa, 29.
Rhodomela subfusca, 29.

(6) MENEMSHA BIGHT.

A special trip to Menemsha Bight was made on July 17, 1905, in the *Genevieve* of the Marine Biological Laboratory. Three hauls were taken, (1) at the east end of Menemsha Bight just outside of the fish traps, bottom sandy in 6½ fathoms; (2) in the middle region between the fish traps, bottom sandy mud in 5½ fathoms; and (3) about three-fourths of a mile offshore at the west end of Menemsha Bight, bottom sandy in 8½ fathoms. The following species were recorded:

Chaetomorpha Linum, 3, few.
Desmarestia viridis, 2, many; 1 and 3, few.
Laminaria Agardhii, 1, 2 and 3, few.
Ralfsia clavata, 3, few.
Sargassum Filipendula, 1, few.
Agardhiella tenera, 1, many.
Antithamnion cruciatum, 1, few.
Antithamnion plumula, 1 and 2, few.
Callithamnion roseum, 2, few.
Ceramium rubrum, 2, few.

Champia parvula, 3, few.
Cystoclonium purpurascens var. *cirrhosum*, 2, many.
Hildenbrandia prototypus, 1 and 3, few.
Phyllophora Brodiaei, 2, few.
Polysiphonia atrorubescens, 2, few.
Polysiphonia elongata, 2 and 3, many.
Polysiphonia fibrillosa, 2, few.
Polysiphonia nigrescens, 1, 2 and 3, very abundant.
Seirospora Griffithsiana, 1, 2 and 3, few.
Spyridia filamentosa, 1, few.

The most remarkable feature of this locality was the great quantity of *Polysiphonia nigrescens*. The flora of these sheltered waters was clearly representative of the warm-water sublittoral formation, a fact of some interest considering its proximity to Gay Head.

An examination in the *Blue Wing* of the shallow waters of Menemsha Bight, off Lobsterville, on August 9, 1904, showed a bottom of sandy mud in 3 fathoms. *Zostera* was plentiful in spots and seems to be establishing itself in this region; there was very little present four or five years previous (Vinal Edwards). There were great quantities of *Ectocarpus siliculosus* as well as *Melobesia Lejolisii* covering the *Zostera*, and a few plants of the following were found: *Agardhiella tenera*, *Chondrus crispus*, and *Cystoclonium purpurascens* var. *cirrhosum*.

(7) TARPAULIN COVE.

Tarpaulin Cove proved interesting in several respects. The westerly side (station 17) has a bottom of sand and gravel in $2\frac{1}{2}$ to 4 fathoms, and there was an abundance of *Desmarestia viridis* and *Antithamnion cruciatum*, and in small quantities *Cladophora gracilis*, *Agardhiella tenera*, *Antithamnion plumula*, *Callithamnion Baileyi*, and *Grinnellia americana*; the dredge brought up large quantities of *Zostera*. The upper end of the cove (station 18) in $2\frac{1}{2}$ fathoms has a bottom of mud and gravel supporting extensive beds of *Zostera*, and an abundance of *Polysiphonia nigrescens*. A line dredged across the entrance of the cove (station 19) showed a muddy bottom with occasional plants of *Polysiphonia nigrescens*. Hauls made at the entrance nearest the lighthouse, July 18, 1903 (Phalarope), showed the presence of much *Seirospora Griffithsiana* and small quantities of *Desmarestia viridis*, *Laminaria Agardhii*, *Agardhiella tenera*, *Callithamnion Baileyi*, *Ceramium fastigiatum*, *Ceramium rubrum*, *Champia parvula*, and *Grinnellia americana*.

(8) VINEYARD HAVEN.

Station 69 off West Chop, at the entrance to Vineyard Haven, was very rich in algæ and especially interesting as a locality for *Rhadinocladia Farlowii*. The bottom was sand and stones in $3\frac{1}{2}$ to 7 fathoms and supported extensive growths of *Zostera*. There was much of the following:

<i>Ralfsia clavata</i> .	<i>Hildenbrandia prototypus</i> .
<i>Rhadinocladia Farlowii</i> (on <i>Zostera</i>).	<i>Lomentaria uncinata</i> .
<i>Sphacelaria radicans</i> .	<i>Melobesia farinosa</i> .
<i>Agardhiella tenera</i> .	<i>Melobesia Lejolisii</i> .
<i>Antithamnion cruciatum</i> .	<i>Phyllophora Brodiaei</i> .
<i>Callithamnion roseum</i> .	<i>Phyllophora membranifolia</i> .
<i>Ceramium tenuissimum</i> .	<i>Spermothamnion Turneri</i> .

In small quantities were:

<i>Cladostephus verticillatus</i> .	<i>Callithamnion corymbosum</i> .
<i>Desmotrichum undulatum</i> .	<i>Dasya elegans</i> .
<i>Ectocarpus confervoides</i> .	<i>Lithothamnion polymorphum</i> .
<i>Sphacelaria cirrhosa</i> .	<i>Polyides rotundus</i> .
<i>Ahnfeldtia plicata</i> .	<i>Spyridia filamentosa</i> .

Vineyard Haven proper (stations 70, 71, 72, and 7762) presented little variety in its algal life but considerable quantities of certain species. Station 70 in 4 fathoms, with a bottom of stones and *Crepidula* shells, gave much *Agardhiella tenera*, *Champia parvula*, *Grinnellia americana*, and *Lomentaria uncinata*; in small quantities were *Rhadinocladia Farlowii* (on *Zostera*), *Antithamnion cruciatum*, *Callithamnion corymbosum*, *Ceramium strictum*, *Ceramium tenuissimum*, *Hildenbrandia prototypus*, *Lithothamnion polymorphum*, and *Melobesia Lejolisii*. Station 71, with a bottom of clam and pecten shells, stones, and mud, in $3\frac{1}{2}$ fathoms, gave an abundance of *Sphacelaria radicans*, *Agardhiella tenera*, *Champia parvula*, *Grinnellia americana*, *Lomentaria uncinata*, and *Phyllophora Brodiaei*. Station 72, stones and mud, in 3 to 4 fathoms, showed large quantities of *Calothrix confervicola*, *Sphacelaria cirrhosa*, *Agardhiella tenera*, *Champia parvula*, *Lomentaria uncinata*, *Melobesia Lejolisii*, and *Spermothamnion Turneri*, and a few plants

of *Enteromorpha clathrata*, *Sphacelaria radicans*, *Grinnellia americana*, and *Polysiphonia Harveyi*. Station 7762, in the middle of Vineyard Haven, had a bottom of mud and shells in $3\frac{1}{2}$ to 4 fathoms; there was an abundance of *Agardhiella tenera*, *Champia parvula*, *Grinnellia americana*, *Lomentaria uncinata*, and small quantities of *Dictyosiphon hippuroides*, *Sargassum Filipendula*, *Phyllophora membranifolia*, *Polysiphonia elongata*, *Spermothamnion Turneri*, and *Spyridia filamentosa*. The bottom of such a harbor as Vineyard Haven always receives large quantities of drifted algæ, some of which are able to vegetate loosely over the bottom; conspicuous among these are *Champia parvula*, *Lomentaria uncinata*, and *Spermothamnion Turneri*. The shallow regions support extensive beds of *Zostera marina*.

Station 7761, off East Chop at the entrance to Vineyard Haven, with a bottom of sand, cinders, and shell fragments in 6 to 7 fathoms, gave much *Sargassum Filipendula*, *Sphacelaria cirrhosa*, *Agardhiella tenera*, *Callithamnion roseum*, *Champia parvula*, *Lomentaria uncinata*, *Phyllophora membranifolia*, and *Spermothamnion Turneri*; in small quantities were *Chordaria flagelliformis*, *Cladostephus verticillatus*, *Dictyosiphon hippuroides*, *Laminaria Agardhii*, *Chondrus crispus*, *Griffithsia Bornetiana*, *Grinnellia americana*, *Lithothamnion polymorphum*, *Phyllophora Brodiaei*, *Polyides rotundus*, *Polysiphonia nigrescens*, *Rhodomenia palmata*, and *Spyridia filamentosa*.

(9) COVE WEST OF CUTTYHUNK NECK.

A cove west of Cuttyhunk Neck (station 101) proved to be one of the most interesting stations in Buzzards Bay because of the abundance of *Arthrocladia villosa*. A special trip was made July 27, 1905, on the *Genevieve* of the Marine Biological Laboratory, one week after this station was discovered, to determine more precisely the habits of this interesting alga. Four hauls were carried across the entrance of the cove from southwest to northeast in 4 to 5 fathoms. The bottom was sandy, with quantities of large clam shells (*Venus mercenaria*), mussel shells, and pebbles, to which the *Arthrocladia* was attached in great abundance. The plants were very large and in full fruit and supplied the set distributed in the Phycotheca Boreali-Americana, fas. D, no. XXX. Besides the *Arthrocladia*, there was much *Desmarestia aculeata*, *Laminaria Agardhii* var. *vittata*, *Cystoclonium purpurascens* var. *cirrhosum*, *Grinnellia americana*, *Phyllophora Brodiaei*, and *Polysiphonia elongata*. In small quantities were found *Chorda filum*, *Desmarestia viridis*, *Dictyosiphon hippuroides*, *Ectocarpus siliculosus*, *Laminaria Agardhii*, *Antithamnion cruciatum*, *Callithamnion roseum*, *Corallina officinalis*, *Polyides rotundus*, and *Scinaia furcellata*.

(10) THE MIDDLE GROUND.

The shallow stretch in Vineyard Sound, known as the Middle Ground (stations 41, 42, and 43), has a bottom of sand and broken shells, 2 to $4\frac{1}{2}$ fathoms at station 41, $3\frac{1}{2}$ to 6 fathoms at station 42, and $2\frac{1}{2}$ to 5 fathoms at station 43. There was no evidence of algal life, and it is probably quite safe to say that no algæ grow on these banks of shifting sand scoured by tidal currents.

4. SOME STATISTICS RELATIVE TO THE DISTRIBUTION OF ALGÆ IN BUZZARDS BAY AND VINEYARD SOUND.

It is a very difficult matter to make in detail a satisfactory comparison of the algal flora of Woods Hole and its vicinity with those of other coasts, chiefly for the reason that the life conditions are so diverse in different sections of the region and at different seasons that there are in reality several floras to be considered. These have been described in the account of the principal formations which may be distinguished (section II, chapter III, pages 468-475), but far more must be known of their composition and habits at other seasons of the year than the summer before their limits can be defined with exactness. The general characteristics of the summer flora of the warmer waters of the region, which is a part of the flora of Long Island Sound, are outlined in the introduction to section II, chapter I, pages 443 and 444.

Comparative studies of algal floras are also rendered very difficult because the floras have generally been described more with regard to the variety and number of species than with respect to the quantities of the dominant forms. A comparison of two lists of species may show that a very large proportion, perhaps a majority of the forms, are not the same, and yet when judged quantitatively, i. e., by the total mass of vegetation composed of species common to both, the two floras might be considered as essentially similar. We have examined lists of species published by surveys or from stations on the Scandinavian coast, the Faroes, Denmark, Clyde Sea area, Plymouth, the Irish Sea, Naples, etc., and considered the possibility of drawing up comparative tables of floras, but we must confess that to us there seemed so little promise of satisfactory results that the work was not undertaken.

In connection with the zoological data presented in section I, chapter III, statistics were tabulated for the distribution of the four classes of algæ and of *Zostera marina* as determined by the dredging operations in Buzzards Bay and Vineyard Sound. The results of that tabulation are presented below. Of especial interest are the statistics for the quantity of vegetation over three types of bottom; Division A, "sand," including bottoms recorded as pure sand or sand and shells (excluding bottoms containing stones, gravel, or mud); division B, "gravel and stones," including records which list either of these ingredients singly, or in combination with one another or with sand (excluding bottoms containing mud); division C, "mud," including bottoms recorded as of mud, muddy sand, or sandy mud (excluding bottoms containing gravel or stones, but including those in which shells are listed). Finally there is presented a table which lists those species that were of such general distribution as to occur at one-fourth or more of the total number of stations, at one-fourth or more of the stations dredged by the *Fish Hawk* and *Phalarope* in both the Bay and Sound, and at one-fourth of the stations of the three types of bottom designated as A, B, and C. These tables follow in the order outlined above.

AVERAGE NUMBER OF GENERA AND SPECIES OF PLANTS TAKEN PER DREDGE HAUL FOR THE 458 STATIONS OF THE REGULAR SERIES.

Groups.	Genera.	Species.
Cyanophyceæ.....	0.004	0.004
Chlorophyceæ.....	.09	.1
Phæophyceæ.....	1.1	1.3
Rhodophyceæ.....	4.3	4.6
<i>Zostera marina</i>1	.1

AVERAGE NUMBER OF GENERA AND SPECIES OF PLANTS TAKEN PER DREDGE HAUL AT THE FISH HAWK STATIONS.

Groups.	Vineyard Sound.		Buzzards Bay.	
	Genera.	Species.	Genera.	Species.
Chlorophyceæ.....	0.02	0.02	0.05	0.05
Phæophyceæ.....	.9	1.0	1.1	1.1
Rhodophyceæ.....	3.4	3.6	2.8	3.0
Zostera marina.....	.1	.1	.1	.1

AVERAGE NUMBER OF GENERA AND SPECIES OF PLANTS TAKEN PER DREDGE HAUL AT THE PHALAROPE AND BLUE WING STATIONS (INSHORE).

Groups.	Vineyard Sound.		Buzzards Bay.	
	Genera.	Species.	Genera.	Species.
Cyanophyceæ.....	0.03	0.03		
Chlorophyceæ.....	.3	.3	0.1	0.1
Phæophyceæ.....	1.8	2.2	1.2	1.3
Rhodophyceæ.....	7.7	8.4	4.8	5.2
Zostera marina.....	.3	.3	.2	.2

AVERAGE NUMBER OF GENERA AND SPECIES OF PLANTS TAKEN AT EACH OF THE FOREGOING GROUPS OF STATIONS, THE CLASSES BEING COMBINED.

	Stations.	Genera.	Species.
Fish Hawk:			
Vineyard Sound.....	278	4.5	4.7
Buzzards Bay.....	66	4.0	4.2
Phalarope (and Blue Wing):			
Vineyard Sound, inshore.....	77	10.1	11.3
Buzzards Bay, inshore.....	90	6.3	6.8
Total.....	451	5.7	6.2

AVERAGE NUMBER OF GENERA AND SPECIES OF PLANTS TAKEN UPON BOTTOMS OF "SAND," DIVISION A (170 STATIONS).

Groups.	Genera.	Species.
Cyanophyceæ.....	0.006	0.006
Chlorophyceæ.....	.1	.1
Phæophyceæ.....	1.3	1.4
Rhodophyceæ.....	4.0	4.3
Zostera marina.....	.1	.1

AVERAGE NUMBER OF GENERA AND SPECIES OF PLANTS TAKEN UPON BOTTOMS OF "GRAVEL AND STONES," DIVISION B (167 STATIONS).

Groups.	Genera.	Species.
Chlorophyceæ.....	0.09	0.09
Phæophyceæ.....	1.2	1.3
Rhodophyceæ.....	5.6	6.0
Zostera marina.....	.1	.1

AVERAGE NUMBER OF GENERA AND SPECIES OF PLANTS TAKEN UPON BOTTOMS OF "MUD," DIVISION C (112 STATIONS).

Groups.	Genera.	Species.
Cyanophyceæ.....	0.009	0.009
Chlorophyceæ.....	.1	.1
Phæophyceæ.....	.9	1.0
Rhodophyceæ.....	2.8	3.0
Zostera marina.....	.2	.2

SPECIES DREDGED AT ONE-FOURTH OR MORE OF THE STATIONS.

[The figures at the top of the columns represent one-fourth of the total number of stations in each group.]

Species.	115 Total stations.	55 Fish Hawk, Sound.	17 Fish Hawk, Bay.	19 Phala- rope, Sound.	23 Phala- rope, Bay.	43 Bottom A, "sand."	42 Bottom B, "gravel and stones."	28 Bottom C, "mud."
Phæophyceæ:								
Desmarestia aculeata.....				20				
Desmarestia viridis.....				19				
Laminaria Agardhii.....				20				
Rhodophyceæ:								
Agardhiella tenera.....				25	32		52	
Antithamnion cruciatum.....				29			46	
Champia parvula.....	139	75		28	23	49	67	
Chondrus crispus.....				42			55	
Corallina officinalis.....				20				
Cystoclonium purpurascens.....				19				
Cystoclonium purpurascens var. cir- rhosum.....				30				
Grinnellia americana.....	140	62	20	27	31	50	60	29
Lithothamnion polymorphum.....				19				
Phyllophora Brodiaei.....				47	23		59	
Phyllophora membranifolia.....				19	38		59	
Polyides rotundus.....				25				
Polysiphonia elongata.....				19				
Polysiphonia nigrescens.....				26				
Spermothamnion Turneri.....				36			44	
Spermatophyta:								
Zostera marina.....				19				